AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in this application.

1. (Currently Amended) An integrated microfluidic device comprising a sample loading chamber and a fluid reservoir connected by a microfluidic channel, wherein

the microfluidic channel comprises an inlet and an outlet,

the sample loading chamber is configured for loading a sample of charged molecules into the microfluidic device, is positioned at the inlet of the microfluidic channel, and comprises

a first electrode and a second electrode configured to generate a first electric field in the sample loading chamber, wherein, when generated, the first electric field is configured to transfer charged molecules in the sample loading chamber to the inlet of the microfluidic channel, and

the fluid reservoir is configured for unloading a sample of separated charged molecules from the microfluidic device, is positioned at the outlet of the microfluidic channel, and comprises a third electrode configured to generate a second electric field with at least the second electrode.

2. (Original) The integrated microfluidic device of claim 1, wherein the charged molecules are nucleic acid molecules.

3. (Original) The integrated microfluidic device of claim 2, wherein the nucleic acid molecules are deoxyribonucleic acids.

4. (Original) The integrated microfluidic device of claim 1, wherein the charged molecules are proteins.

5. (Currently Amended) An integrated microfluidic device comprising a sample loading chamber and a fluid reservoir connected by a microfluidic channel, wherein

the microfluidic channel comprises an inlet and an outlet,

the sample loading chamber is configured for loading a sample of charged molecules into the microfluidic device, is positioned at the inlet of the microfluidic channel, and comprises

a first electrode and a second electrode configured to generate a first electric field in the sample loading chamber, and a section of matrix material comprising charged molecules in the sample loading chamber;

wherein, when generated, the first electric field is configured to electro-elute the charged molecules from the section of matrix material and to transfer the charged molecules to the inlet of the microfluidic channel, and

the fluid reservoir is configured for unloading a sample of separated charged molecules from the microfluidic device, is positioned at the outlet of the microfluidic channel, and comprises a third electrode configured to generate a second electric field with at least the second electrode.

6. (Original) The integrated microfluidic device of claim 5, wherein the charged molecules are nucleic acid molecules.

7. (Original) The integrated microfluidic device of claim 6, wherein the nucleic acid molecules are deoxyribonucleic acids.

8. (Original) The integrated microfluidic device of claim 7, wherein the deoxyribonucleic acids have a size greater than about 50 kilobases.

9. (Original) The integrated microfluidic device of claim 5, wherein the charged molecules are proteins.

10. (Original) The integrated microfluidic device of claim 5, wherein the charged molecules are polypeptide-sodium dodecyl sulfate supra-molecules.

11. (Original) The integrated microfluidic device of claim 5, wherein the section of matrix material is a gel plug.

12. (Original) The integrated microfluidic device of claim 11, wherein the gel plug is an agarose gel plug.

13. (Previously Presented) The integrated microfluidic device of claim 5, wherein the sample loading chamber comprises three electrodes.

14. (Original) The integrated microfluidic device of claim 5, wherein the two electrodes generate repeatedly inverted electric pulses.

15. (Currently Amended) An integrated microfluidic device comprising a sample unloading chamber and a fluid reservoir connected by a microfluidic channel, wherein

the microfluidic channel comprises an inlet and an outlet,

the sample unloading chamber is configured for unloading a sample of charged molecules from the microfluidic device, is positioned at the outlet of the microfluidic channel, and comprises

a first electrode and a second electrode configured to generate a first electric field in the sample unloading chamber, the sample unloading chamber defining an opening in the microfluidic device, wherein at least a portion of the first and second electrodes is in the opening, and, wherein, when generated, the first electric field is configured to transfer charged molecules from the outlet of the microfluidic channel into the sample unloading chamber, and

the fluid reservoir is positioned at the inlet of the microfluidic channel, and comprises a third electrode configured to generate a second electric field with at least the second electrode.

16. (Original) The integrated microfluidic device of claim 15, wherein the charged molecules are nucleic acid molecules.

17. (Original) The integrated microfluidic device of claim 16, wherein the nucleic acid molecules are deoxyribonucleic acids.

18. (Original) The microfluidic device of claim 17, wherein the deoxyribonucleic acids are greater than about 50 kilobases in size.

19. (Original) The integrated microfluidic device of claim 15, wherein the charged molecules are proteins.

20. (Currently Amended) An integrated microfluidic device comprising a sample unloading chamber and a fluid reservoir connected by a microfluidic channel, wherein

the microfluidic channel comprises an inlet and an outlet,

the sample unloading chamber is configured for unloading a sample of charged molecules from the microfluidic device, is positioned at the outlet of the microfluidic channel, and comprises

a first electrode and a second electrode configured to generate a first electric field in the sample unloading chamber, and a section of matrix material in the sample unloading chamber, wherein the matrix material is only present in the sample unloading chamber;

wherein, when generated, the first electric field is configured to transfer charged molecules from the outlet of the microfluidic channel into the section of matrix material, and

the fluid reservoir is positioned at the inlet of the microfluidic channel and comprises a third electrode configured to generate a second electric field with at least the second electrode.

21. (Original) The integrated microfluidic device of claim 20, wherein the charged molecules are nucleic acid molecules.

22. (Original) The integrated microfluidic device of claim 21, wherein the nucleic acid molecules are deoxyribonucleic acids.

23. (Original) The integrated microfluidic device of claim 22, wherein the deoxyribonucleic acids have a size greater than about 50 kilobases.

24. (Original) The integrated microfluidic device of claim 20, wherein the charged molecules are proteins.

25. (Original) The integrated microfluidic device of claim 20, wherein the section of matrix material is a gel plug.

26. (Original) The integrated microfluidic device of claim 25, wherein the gel plug is an agarose gel plug.

27. (Canceled)

28. (Canceled)

29. (Canceled)

30. (Canceled)

31. (Canceled)

32. (Canceled)

33. (Canceled)

34. (Canceled)

35. (Canceled)

36. (Canceled)

37. (Canceled)

38. (Canceled)

39. (Canceled)

40. (Canceled)

41. (Canceled)

42. (Canceled)

42. (Canceled)

43. (New) The integrated microfluidic device of claim 1, wherein the loading chamber defines an opening in the microfluidic device, and at least a portion of the first and second electrodes is in the opening.

44. (New) The integrated microfluidic device of claim 5, wherein the loading chamber defines an opening in the microfluidic device, and at least a portion of the first and second electrodes is in the opening.

45. (New) The integrated microfluidic device of claim 5, wherein the matrix material is only present in the sample loading chamber

46. (New) An integrated microfluidic device comprising a sample unloading chamber and a fluid reservoir connected by a microfluidic channel, wherein

the microfluidic channel comprises an inlet and an outlet,

the sample unloading chamber is configured for unloading a sample of charged molecules from the microfluidic device, is positioned at the outlet of the microfluidic channel, and comprises

a first electrode and a second electrode configured to generate a first electric field in the sample unloading chamber, and a section of matrix material in the sample unloading chamber, the sample unloading chamber defining an opening in the microfluidic device, and at least a portion of the first and second electrodes is in the opening;

wherein, when generated, the first electric field is configured to transfer charged molecules from the outlet of the microfluidic channel into the section of matrix material, and

the fluid reservoir is positioned at the inlet of the microfluidic channel and comprises a third electrode configured to generate a second electric field with at least the second electrode.